USACE - St. Paul District

2006 Standard Operation Procedures for Collecting Transparency Tube Measurements at Lock and Dams on the Mississippi River.

Background/Purpose

A transparency tube, also known as turbidity tube, is a simple instrument for making measurements of water clarity or providing estimates of turbidity and suspended particulate matter concentrations in water. Transparency tube measurements are especially useful in flowing waters or when sampling from dams and bridges where more conventional transparency measurements (Secchi disk) can't be used.

Transparency Tube Device and Use

The particular model utilized for this program is a clear, narrow (4.5 cm), graduated, plastic tube (60 cm long) that has a Secchi disc image and drain tube at the bottom. A representative water sample from the monitoring location is collected and poured into or drained from the tube slowly until the black white disk disappears (filling) or appears (draining). The height of water above the disk at this is point is noted. The process is repeated and the average of the two readings is recorded.

Equipment –Transparency tube, bucket and rope. The sampling bucket and rope should be dedicated for collecting river water samples and kept clean when not in use. A small sieve or strainer may be needed if large debris is present.

Site Selection – The proposed Upper Mississippi River sampling sites are LD1, LD2, LD3, LD5, LD7, LD8, LD9 & LD10. At each site, it is important to obtain a representative sample of river water where there is some current and turbulence. To provide sampling consistency the monitoring sites should be consistent to enhance comparisons between monitoring sites and evaluating temporal changes. Possible sites include the river wall immediately upstream of the roller gates, along the guidewalls where river current is present. Samples from the lock chamber should be avoided since solids may settle when the lock chamber is idle or have excessive turbidity following the release of a towboat. Once a suitable site is identified, this site should be the primary site monitored to maintain sampling consistency.

Collection Schedule- Each Lock and Dam should collect two samples a week between April 1st and Oct. 31st.

Collection Time- A mid-day collection (11:30 to 13:30) is recommended to provide sampling consistency. Avoid sampling immediately following lockage of a towboat or other large vessels. Wait at least 10 minutes before collecting the water sample after passage of a large towboat or large vessel.

Methods –

1. Collect water sample with bucket and rope. If surface water has substantial floating debris discard sample and try again. If it is not possible to obtain water free of large debris it may be necessary to pass water through small a screen or sieve as the transparency tube is filled.
2. Close the finger clamp on the plastic drain tube.
3. Make sure the Secchi disk image is clean.
4. Push the rubber stopper into the bottom of the tube until the Secchi disk image aligns with the “0” cm mark on the scale.
5. Place the transparency tube upright on a flat surface.
6. Remove sunglasses and stand out of direct sunlight. Shade the transparency tube with your body if nearby shade is not available.
7. Stir the water in the bucket and then immediately pour the sample into the transparency tube until the Secchi disk image just disappears when viewed from above. Take care not to produce too many air bubbles as they will scatter light and affect the reading.
8. Hold the transparency tube with the opening a few inches from your eye.
9. Slowly drain water by releasing the drain valve and holding a finger over the outlet tubing while looking for the black and white disk to appear.
10. Once the disk immediately becomes apparent, stop the water release and record the height of water above the disk in centimeters (to the nearest cm). Readings midway between cm increments should be recorded as the higher cm value. If the Secchi disk image is visible when the tube is full, the reading is “>60 cm.” Discard the water sample in transparency tube and repeat steps 7 through 10.
11. Record the second transparency measurement.
12. Calculate the average of the two transparency measurements by adding the two readings and divide by 2. Record the average measurement on a daily log sheet that will represent the final measurement.

Notes:

Make sure that the sample is sufficiently mixed and that the reading is taken as quickly as possible in order to prevent sediment from accumulating on the Secchi disk image.
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Cleaning – Keep transparency tube and sampling bucket clean and store dry when not in use. Rinse equipment with tap water after use.

Occasionally remove the rubber stopper and clean the Secchi disk image so it does not become dirty and clouded.

Transparency tube measurement from canoe